

REMARKS

Claims 1-5, 7-9, 11-13, 15-23, and 26-30 are all the claims pending in the application.

Claims 1-5, 7-9, 11-13, 15-23, and 26-30 have been rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Sudo et al (WO 03/028128).

This rejection is substantially identical to the Examiner's previous rejection based on Sudo et al.

Applicants submit that Sudo et al do not disclose or render obvious the presently claimed invention and, accordingly, request withdrawal of this rejection.

In the present invention, there is a dispersing of a graphite crystalline texture and an amorphous texture from the surface to the core of a particle, wherein the particle has a substantially uniform structure from the surface to the center portion of the particle. Applicants have amended claim 1 to specifically state that the particle has a substantially uniform structure from the surface to the center portion of the particle. Support for this amendment can be found in the Abstract and at page 4, lines 27 to 30 of the specification.

As applicants have previously argued, in Sudo et al, the structure becomes different on the surface and at the core of the particle because the surface of the particle has an amorphous-rich structure, the core has a graphite-rich structure and the particle as a whole has a non-uniform structure. Thus, as applicants have previously argued, Sudo et al provide a non-uniform structure, whereas the present invention provides a substantially uniform structure.

The Examiner has responded to this argument by stating that the argument is not commensurate with the scope of the claims because there is no limitation in the claims that requires a substantially uniform structure from the surface to the center portion of the particle.

As discussed above, applicants have amended claim 1 to specifically state that the particle has a substantially uniform structure from the surface to the center portion of the particle. Accordingly, applicants' arguments are commensurate in scope with the claims as amended above.

Applicants have also previously argued that Sudo et al teach that resin is deposited onto natural graphite particles.

The Examiner has responded to this argument by stating that there is no limitation in the claims that precludes the use of natural graphite particles.

In response, applicants point out that the present specification describes granulated natural graphite in Example 2. The graphite of Example 2 satisfies the requirements as defined in the present claims. Meanwhile, the natural graphite in Comparative Example 1 of the present specification does not satisfy the requirements of the claims.

There are two types of natural graphite. The natural graphite in Example 2 comprises amorphous structure regions which were generated by being subjected to mechanical stress at the time of granulating. The natural graphite disclosed in Example 1 of Sudo et al is massive (lump-shaped) natural graphite.

Further, applicants have previously argued that phenol resin, which is disclosed in Sudo et al, normally is not a graphitizable raw material. Applicants have argued that, therefore, the carbon derived from phenol resin in Sudo et al is amorphous carbon, even after it is heated at a high temperature and that this means that the surface having a large amount of the resin in Sudo et al becomes amorphous-rich carbon. Accordingly, the crystallinity in Sudo et al becomes non-uniform on the surface and at the core of the obtained particles.

The Examiner responds to the above argument by stating that even assuming that phenol resin is not a graphitizable raw material and the carbon derived from phenol resin in Sudo et al is amorphous carbon, there is no evidence to show that phenol resin does not permeate into natural graphite particles to form graphite crystal structure regions and amorphous structure regions distributed throughout the entirety of the carbon material.

In response, applicants submit that there is evidence to show that in Sudo et al phenol resin does not permeate into natural graphite particles.

Example 1 of the present specification employs a method of mixing carbon and resin materials and then polymerizing the mixture. On the other hand, Sudo et al employ a method of mixing a polymer as it is into carbon. Since the resin material used in the present invention is not a polymer and has very low viscosity, it readily permeates into little cracks and voids in the carbon particles.

On the other hand, the polymer of Sudo et al has high viscosity and has difficulty in permeating into the carbon particles, though the polymer may attach onto the carbon surface.

Accordingly, one of ordinary skill in the art would readily understand that the phenol resin of Sudo et al does not permeate into the natural graphite particles in Sudo et al.

Since Sudo et al use massive (lump-shaped) natural graphite, which serves as the core particles, and phenol resin having high viscosity, the phenol resin does not permeate into the natural graphite particles of Sudo et al and therefore the carbonaceous particles of Sudo et al cannot provide a uniform structure.

In view of the above, applicants submit that Sudo et al do not disclose or render obvious the presently claimed invention and, accordingly, request withdrawal of this rejection.

The Examiner sets forth six rejections of the claims based on Yamada (JP 10-116605) as a primary reference.

Each of these six rejections are substantially identical to the Examiner's previous rejections based Yamada and the various secondary references.

The six rejections are as follows:

Claims 1-5, 7, 9, 10, 13, 15, 18, 19, 22, 23, and 26-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada (JP 10-116605) in view of Nakai et al (US 6447946).

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada (JP 10-116605) in view of Nakai et al (US 6447946) as applied to claim 1 above.

Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada (JP 10-116605) in view of Nakai et al (US 6447946) as applied to claim 1 above, and further in view of Yamazaki et al (US 2002/0160266).

Claims 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada (JP 10-116605) in view of Nakai et al (US 6447946) as applied to claim 15 above, and further in view of Mrotek et al (US 5776633).

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada (JP 10-116605) in view of Nakai et al (US 6447946) as applied to claim 18 above, and further in view of Gernov et al (US 6194099).

Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada (JP 10-116605) in view of Nakai et al (US 6447946) as applied to claim 18 above, and further in view of Nishimura et al (US 6528211).

Applicants submit that Yamada, Nakai et al, Yamazaki et al, Mrotek et al, Gernov et al and Nishimura et al do not disclose or render obvious the presently claimed invention and, accordingly, request withdrawal of these rejections.

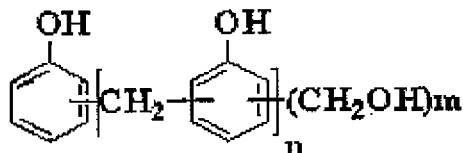
Applicants submit that the primary reference to Yamada does not disclose or suggest a particle that has a substantially uniform structure from the surface to the center portion of the particle as set forth in claim 1 as amended above. The secondary references do not supply this deficiency of Yamada.

Yamada teaches in paragraph [0036] that the negative electrode material of Yamada has a two-layer structure in which the surface of carbon fiber is coated with the carbon derived from thermosetting resin, and teaches in paragraph [0020] that the effects of the invention are achieved by the interaction of the carbon fiber and the carbon coated on the surface in the two-layer structure. That is, the two-layer structure in Yamada is a prerequisite for the negative electrode material of Yamada. Accordingly, Yamada does not disclose or suggest a substantially uniform structure as in the present invention.

In Example 1 of the present specification, a product formed of carbonaceous particles and phenol resin is produced by a novolac-type reaction. Applicants attach a three page explanation of a "Production mechanism of phenol resin," including an explanation of a novolac-type reaction which is set forth in section (b) of the Attachment.

The point of Example 1 of the present specification is to make the reaction proceed not by mixing a monomer having high viscosity such as novolac represented by the formula below and carbon, but by mixing the materials of novolac in the state of phenol and formalin (they have much lower viscosity than a monomer) with carbon, adding hexamethylenetetramine to the

mixture, making these materials permeate into the inside of the particles in vacuum and heating the resultant product.



Applicants assume that the above method enables making the materials penetrate into fine cracks and voids of the carbonaceous particles, thereby making the reaction proceed.

Although this method is employed in Comparative Example 1 of the present specification, the materials do not permeate into the carbonaceous particles since the graphite particles are dense inside and have high crystallinity.

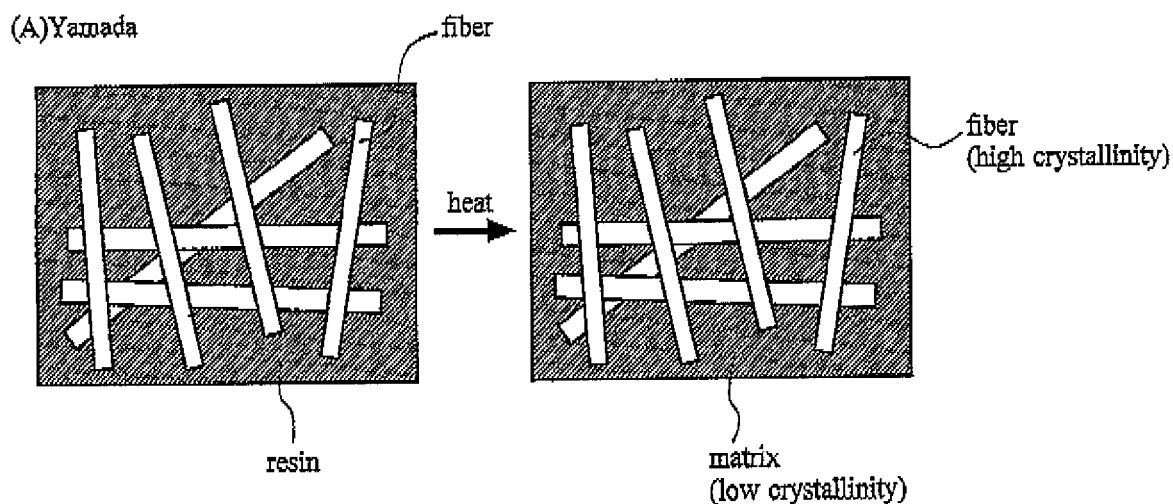
In Example 3 of the present specification, a monomer is substantially diluted with ethanol and water to lower the viscosity and force the polymer to penetrate into the carbonaceous particles, and the obtained particles managed to fall within the claimed range of the present invention.

Yamada neither discloses nor suggests the concepts of the present invention or the inventiveness of the present invention.

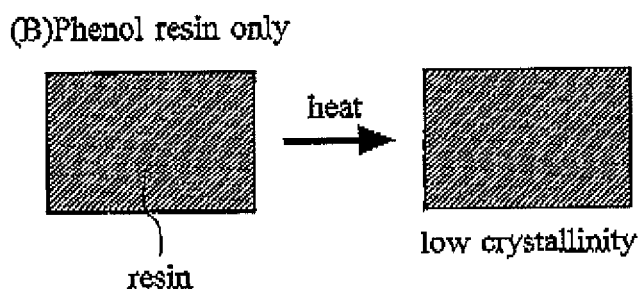
Applicants set forth the following explanation to show that Yamada cannot provide a uniform structure.

(A) In Yamada, a solution containing phenol resin is impregnated into a carbon fiber sheet and the sheet is subjected to thermal treatment. The carbon fiber portions have high crystallinity. However, phenol resin is a material which is difficult to be graphitized and generally cannot attain high crystallinity even by undergoing thermal treatment, and therefore,

the resin portion of the obtained product has low crystallinity. Applicants illustrate this in the below representation.



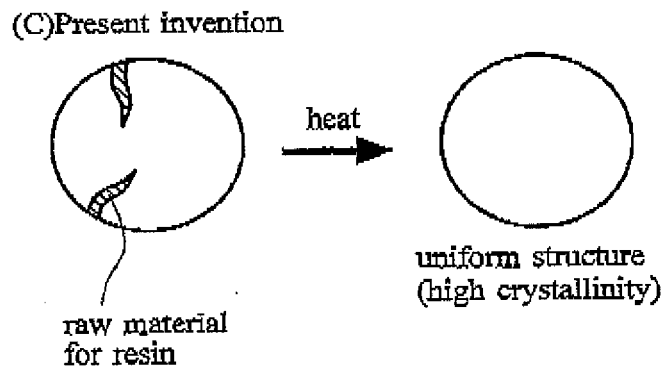
(B) Even if resin only is subjected to thermal treatment, it produces the same results as in the resin portion (matrix) of Yamada. Since phenol resin is a material which is difficult to be graphitized and generally cannot attain high crystallinity even by undergoing thermal treatment, and therefore the resin portion of the obtained product has low crystallinity. Applicants illustrate this in the below representation.



(C) In the present invention, when phenol resin exists in fine cracks of carbonaceous particles which is readily graphitized and the carbonaceous particles undergo phase-change into

highly-crystallized graphite, phenol resin closely attached to carbonaceous particles, which resin will not be graphitized normally by thermal treatment, tends to be simultaneously graphitized.

Applicants illustrate this in the below representation.



Therefore, applicants submit that the present invention provides an almost uniform structure. This phenomenon occurs only in the phenol resin in vicinity to the carbonaceous particles to be crystallized.

Like Yamada, phenol resin apart from the carbonaceous particles (carbon fiber sheet) will not be crystallized. As is apparent from the above discussion, Yamada does not provide a uniform structure.

In view of the above, applicants submit that Yamada, Nakai et al, Yamazaki et al, Mrotek et al, Gernov et al and Nishimura et al do not disclose or render obvious the presently claimed invention and, accordingly, request withdrawal of each of the six rejections based on Yamada.

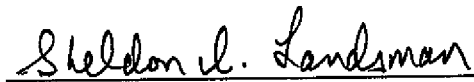
In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

AMENDMENT UNDER 37 C.F.R. § 1.116
Appln. No.: 10/559,615

Attorney Docket No.: Q76011

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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CUSTOMER NUMBER

Date: April 8, 2011

ATTACHMENT

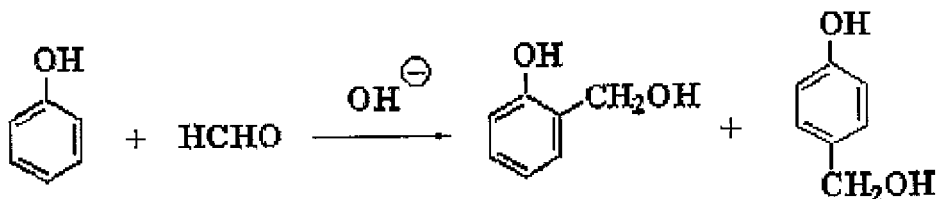
Thermosetting resins such as phenol resin, urea resin and melamine resin, which are used widely as industrial materials for commodities, are produced using addition condensation reaction.

Production mechanism of phenol resin

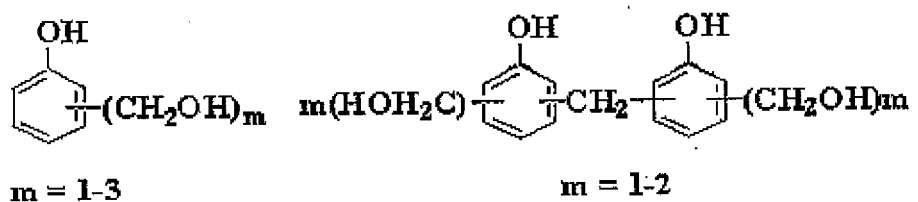
Phenol resin is produced by two-stage reactions: i.e. production reaction of a prepolymer (resol and novolac) and crosslinking reaction of the prepolymer.

(a) Production mechanism of resol

Phenolate is produced by adding base to phenol. The anion has high π electron density at o-position and p-position. Through the reaction with formaldehyde, methylol group is introduced at o-position and p-position.



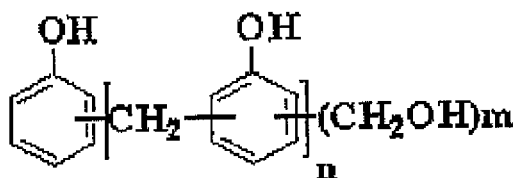
The mono-methylated phenol, in which π electron density of the benzene ring becomes further higher, further reacts with formaldehyde to thereby produce resol having a number of methylol groups.



When resol is made acidic or heated, a condensation reaction occurs preferentially, thereby producing crosslinked polymer.

(b) Production mechanism of novolac

Under an acidic condition, formaldehyde is protonated into carbonyl oxygen, which serves as electrophile and causes electrophilic addition reaction to phenol. Methylol group introduced into phenol is to be protonated by acid, followed by production of carbocation by dehydration, which reacts with phenol to thereby produce a methylene bond. Under an acidic condition, condensation reaction occurs in preference to addition reaction. When the addition-condensation reaction is repeated, novolac is produced.



When a crosslinking agent such as hexamethylenetetramine represented by the following formula is added to novolac and the mixture is heated, the crosslinking reaction proceeds and the mixture is cured, thereby producing a polymer.

